option allowing multiple pre-selections could require a substantial upgrade in processor hardware[31].

TXE4s cause some difficulties. While BT intends to replace them eventually, the timescales for this are unclear - many will almost certainly still be present throughout 1997, and a date of around 2000 seems more likely for total replacement. TXE4s could not handle pre-selections. Call by call equal access could possibly be achieved but only in bizarre ways, which would require significant development - eg the switch is provided with an input filter to admit only calls beginning with 1xxx (for calls to OLOs), which are handled as two-stage easy access calls currently are, or a separate pre-determined eight digit string (eg 0000 - for calls to BT) which is discarded by a separate input filter. It is assumed that, rather than do this, it would be acceptable to implement equal access on replacement switches as and when TXE4s are phased out.

It is unlikely to be economic to implement equal access on UXD5s, although Martlesham Labs are investigating the options. It is more likely that the UXD5s in service would be replaced by remote concentrator units and the lines rehosted on larger DLEs.

Interconnection information

Both two stage and one stage easy access options could be adapted to provide equal access services without too much difficulty.

An outstanding question is whether OLOs would request traffic routed via pre-selection to be separately identified in the signalling information, since this would complicate routing decodes. More generally, the issue arises as to what is the relationship between the 1xxx codes for the existing indirect access products and the equal access products - can access codes be reused or will new 1xxx allocations be required?

Inter-network call accounting need not be affected, although OLOs might request additional information from BT on the profile of calls being charged to them.

Changes to BT's information systems

The CSS database is a complex one. In particular, the entity "customer" is complex; for example, it can be associated with:

- a single line at a single site;
- multiple lines at a single site;
- multiple lines at multiple sites.

[31] BT makes the point that there is a presentational aspect of multiple pre-selections: customers are unlikely to realise that it is as difficult to go from six to seven options as from zero to one. If investment were made on the basis of, say, three possible pre-selections it would be difficult to argue why a fourth could not be accommodated. This effect has not been costed.

This raises a number of options for implementing equal access. The simplest would be to associate the preference with the line, but others might link to sites or groups of sites.

The primary impact of equal access would be the requirement to install the configuration of customer preferences in CSS. However the necessity to write new IS transactions for operators to set, revise, replay and monitor customer preferences and the take-up of equal access products would also take time and effort.

There could be impacts on CSS "satellite" systems, such as fraud detection systems. However the design and implementation of any changes directly triggered by equal access is likely to be very small compared with the cost of changing CSS itself. Moreover, some changes to these systems do not represent a difference between easy and equal access.

There would be additional impacts on staff training (for engineering staff, operators and back office staff) and possibly also on manning levels for service support centres, at least temporarily.

Timing

Significant changes to BT's information systems, or indeed to its network architecture, would clearly need to be adequately researched and designed. The relevant design authorities in BT would need to be involved and the expenditure of time and money approved. Manufacturers and systems integrators, within and external to BT, would need a suitable definition of technical requirements and contractual agreements to be in place.

Once equal access was mandated, it is likely that the design and approval process would take a year or so, and the actual build of equal access products into CSS and the network would take a further six months to a year. Overall, therefore, we would expect the implementation of equal access to take 18 months to 2 years.

4.3.3. Implementation Scenarios

It is assumed that equal access services are provided in the first instance without changing BT's network architecture, ie other licensed long distance operators remain connected at BT's DMSUs. Hand off is achieved as for easy access, in either a one or two stage process.

Other possibilities, based on OLOs connecting directly to the local exchange or on intelligent network solutions, are possible and technically feasible. The likeliest situation would be for BT to introduce these services gradually to meet OLOs' demands. Although these changes in connectivity are difficult to plan and expensive to implement, they are equally applicable to easy access. There would be little difference in cost (if any) between easy and equal access, apart from the changes required for the baseline implementation scenario.

It is assumed that BT adopts the simplest solution to implementing an equal access product, in which pre-selection is applied to individual lines and not to other entities (e.g. customer). The following scenarios have been costed:

- Scenario 1:
  - equal access is implemented in a rolling programme in existing switches, where it is readily feasible, and in replacement switches as they roll out;
  - each customer may preselect only one long line operator (although call by call access may still be available to international operators and other national operators).
- Scenario 2:
  - equal access is implemented in major switches as soon as possible, and implemented in TXE and UXD replacements as they roll out;
  - each customer may preselect only one long line operator (although call by call access may still be available to international operators and other national operators).
- Scenario 3:
  - equal access is implemented in a rolling programme in existing switches, where it is readily feasible, and in replacement switches as they roll out;
  - each customer may preselect several long line operators (national and international) separately.
- Scenario 4:
  - equal access is implemented in major switches as soon as possible, and implemented in TXE and UXD replacements as they roll out;
  - each customer may preselect several long line operators (national and international) separately.

It is assumed that existing easy access services would be phased out following the introduction of equal access services. However this process is not costed.

One further point is that BT has stated that it "currently has no plans for systematic replacement of its TXE4 and UXD5 equipment" and indeed that "recent reviews have confirmed that alternative investment proposals represents a better use of shareholders'

resources". In view of this, the replacement timetable suggested below for Scenarios 1 and 3 may be optimistic.

4.4. Cost Analysis: BT Systems

4.4.1. Introduction

The introduction of equal access will affect a number of aspects of BT's systems and operations:

- the network (Section 4.4.2);
- back office systems, specifically CSS (Section 4.4.3);
- data build (Section 4.4.4);
- staff, training and organisation (Section 4.4.5).

The costs in this section have been estimated by Smith System Engineering on the basis of:

- discussions with BT to establish the nature of the network and support systems, and estimates of the general complexity of the system changes required;
- discussions with switch manufacturers;
- estimates of system development costs based on previous experience.

This analysis has been reviewed by BT and a number of minor revisions have been made which, in particular:

- clarify that certain replacements are assumptions rather than firm BT business plans;
- rule out any attempt to implement equal access on TXE4 and UXD5 exchanges still in service, due to the very substantial cost;
- increase the cost estimates for Scenarios 3 and 4 (multiple pre-selection options).

Unless otherwise stated, all figures contained in this section are estimates produced by Smith System Engineering. Those estimates supplied by BT are intended to provide a general indication of the costs of implementing equal access, and will need to be refined to reflect the precise form of equal access, the timing of equal access and other factors.

4.4.2. Changes to BT's network

In order to put equal access in place the following network changes would be needed:

- in local exchanges, each customer would need to have space to mark his long distance operator preference (if he chose to have one);

- in local exchanges, the routing table would need to be reprogrammed to understand and correctly route numbers dialled with the relevant long distance operator prefixes.

The cost of making this change is unlikely to vary significantly between options 1, 2 and 3, since all involve the option of pre-selection.

The costs presented here do not include any provision for expanding the power of the processor hardware in the switches. Although the actual impact of equal access will be small, it may hasten the decision to expand switch processor power. This impact is very difficult to assess, and it is assumed that there are no significant costs within the time horizons of this study. (However a more detailed assessment of feasibility and costs may be required if it were decided that this cost should affect BT's interconnection charges.)

The cost of implementing equal access will vary between the different scenarios, as shown on the following pages.

Scenario 1

It is assumed that:

- System X switches can be adapted for equal access by a rebuild of the customer data and routing tables, with roll-out beginning in 1997. The cost would be around £0.5M (one-off) for new software, plus £2k per switch for reconfiguration (including all routing table rebuild but no customer data download);

- AXEs will need expansion, major reconfiguration of the routing bus structure and possibly support from coprocessing hardware (effectively a "local IN" solution). The cost would be around £1M (one off) for new software, £5k per switch for reconfiguration, and a further £10k per switch for new hardware or a coprocessor. Implementation begins in 1999 following a two year feasibility study costing £0.4M;

- TXEs are not enhanced. Instead it is assumed that they are replaced steadily between 1999 and 2002 by switches capable of providing equal access. The incremental cost of providing equal access in new switches is taken to be £1k per switch;

- the small UXDs are not enhanced. They are replaced in the same timescale as the TXEs and the marginal cost is taken to be minimal (say £0.1k per switch).

Annual maintenance and other support costs for the new software and AXE hardware are estimated to be 10% of capital investment costs. The network costs for this scenario are as shown in Table 4.1

Table 4.1
Network Development Costs to BT (Scenario 1)

Calendar year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
Capital costs, £M											
System X			1.1	0.5							1.6
AXE10			0.2	0.2	1.8	0.8	0.8				3.8
TXE4					0.1	0.1	0.1	0.1			0.4
UXD5					0.01	0.01	0.01	0.01			0.04
Support costs, £M											
System X				0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.35
AXE10						0.18	0.26	0.34	0.34	0.34	1.46
TXE4						0.01	0.02	0.03	0.04	0.04	0.14
UXD5											0
Total cost			1.3	0.75	1.96	1.15	1.24	0.53	0.43	0.43	7.79

Source: Smith analysis

Scenario 2

It is assumed that:

- System X switches are adapted as in Scenario 1, and at similar cost.
- AXEs are expanded as in Scenario 1 but with implementation from 1997. Capital cost would be higher: around £2M (one off) for new software, £5k per switch for reconfiguration, and a further £20k per switch for new hardware or a coprocessor. A short feasibility study costing £0.2M is also allowed for.
- TXEs and UXDs are replaced as in Scenario 1, and at similar cost[32].

Annual maintenance and other support costs for the new software and hardware are estimated to be 10% of capital investment costs - except for AXE upgrades for which 15% is taken, since its rapid implementation will involve a substantial risk of subsequent expenditure resulting from problems not detected during development.

The network costs of this scenario are shown in Table 4.2.

[32] Early replacement of these switches would be inordinately costly. BT suggests £57M for UXD replacement and associated network upgrades; we estimate that replacement of TXEs might cost £1M per switch, for a total of ~£400M, plus several more tens of millions of pounds for network upgrades.

Table 4.2

Network Development Costs to BT (Scenario 2)

Calendar year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
Capital costs, £M											
System X			1.1	0.5							1.6
AXE10		0.2	3.4	1.4	1.4						6.4
TXE4					0.1	0.1	0.1	0.1			0.4
UXD5					0.01	0.01	0.01	0.01			0.04
Support costs, £M											
System X				0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.35
AXE10				0.4	0.6	0.8	0.8	0.8	0.8	0.8	5.0
TXE4						0.01	0.02	0.03	0.04	0.04	0.14
UXD5											0
Total cost		0.2	4.5	2.35	2.16	0.97	0.98	0.99	0.89	0.89	13.93

Source: Smith analysis

Scenario 3

It is assumed that:

- System X and AXEs will need expansion of memory, major reconfiguration of the routing bus structure and possibly support from coprocessing hardware (effectively a "local IN" solution). The cost would be around £1M (one-off) for new software (for each system), £5k per switch for reconfiguration, and a further £25k per switch for new hardware or a coprocessor. Implementation begins in 1999, following a two year feasibility study process costing £1M.

- TXEs and UXDs are replaced in the same timescale as in Scenario 1, but the marginal cost is significantly higher because of the greater requirement for functionality, routing table configuration and processor power (say £20k per TXE replacement and £1k per UXD replacement).

Annual maintenance and other support costs, for the new software and hardware, are estimated to be 10% of capital investment costs.

The network costs of this Scenario therefore as shown in Table 4.3.

Table 4.3
Network Development Costs to BT (Scenario 3)

Calendar year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
Capital costs, £M											
System X			0.25	0.25	6.6	5.6	5.6				18.3
AXE10			0.25	0.25	2.6	1.6	1.6				6.3
TXE4					2.0	2.0	2.0	2.0			8.0
UXD5					0.1	0.1	0.1	0.1			0.4
Support costs, £M											
System X						0.66	1.22	1.78	1.78	1.78	7.22
AXE10						0.26	0.44	0.60	0.60	0.60	2.5
TXE4						0.2	0.4	0.6	0.8	0.8	2.8
UXD5						0.01	0.02	0.03	0.04	0.04	0.14
Total cost			0.5	0.5	11.3	10.43	11.38	5.11	3.22	3.22	45.66

Source: Smith analysis

Scenario 4

It is assumed that:

- System X and AXEs are given memory expansions as in Scenario 3 but with implementation from 1997. Capital cost would be higher: around £2M one-off for new software (for each system), £10k per switch for reconfiguration, and a further £50k per switch for new hardware or a coprocessor. A short feasibility study of £0.4M is allowed for.
- TXEs and UXDs are replaced in Scenario 3, and at similar cost.

Annual maintenance and other support costs, for the new software and hardware, are estimated to be 10% of investment costs - except for the System X and AXE upgrades for which 15% is taken, since its rapid implementation will lead to a substantial risk of subsequent expenditure resulting from problems not detected during development.

The network costs of this scenario are shown in Table 4.4.

Table 4.4
Network Development Costs to BT (Scenario 4)

Calendar year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
Capital costs, £M											
System X		0.2	13.2	11.2	11.2						35.8
AXE10		0.2	5.2	3.2	3.2						11.8
TXE4					2.0	2.0	2.0	2.0			8.0
UXD5					0.1	0.1	0.1	0.1			0.4
Support costs, £M											
System X				1.98	3.66	5.34	5.34	5.34	5.34	5.34	32.34
AXE10				0.78	1.26	1.74	1.74	1.74	1.74	1.74	10.74
TXE4						0.2	0.4	0.6	0.8	0.8	2.8
UXD5						0.01	0.02	0.03	0.04	0.04	0.14
Total cost		0.4	18.4	17.16	21.42	9.39	9.60	9.81	7.92	7.92	102.02

Source: Smith analysis

4.4.3. Changes to BT's information systems

The primary impact of equal access would be the requirement to install the configuration of customer preferences in CSO (see Section 4.4.4). However the necessity to write new IS transactions, to allow operators to set, revise, replay and monitor customer preferences and the take-up of equal access products, would also take time and effort.

It is estimated that 1000 operator transactions need to be written or require significant changes to be made in existing processes. Average development times are taken as 1 man day for design, 5 man days for development/coding, 1 man day for module testing and 2 man days to integrate and test the system. The total cost is 9 man days, which at £50k per man year is equivalent to around £2k per transaction or around £2M in total.

Database and system function changes are more difficult to cost but, as a crude estimate, the same effort again (around 40 man years or £2M) is likely to be a realistic minimum.

In addition this software would need to be maintained. A 10% per annum cost for the eight years 1997 - 2004 inclusive adds a further cumulative £3.2M to the cost of equal access.

These costs might vary slightly between service options. For instance, option 1 (overrideable preselect only) would probably require slightly less development work than option 2 (overrideable preselect and call-by-call). However it is believed that the differences will be minor.

For comparison, BT have independently estimated that implementing equal access on CSS would cost:

- £3M - £4M for options including pre-selection (presumably excluding maintenance);
- £0.5M - £1M for call-by-call options only.

Thus varying the call-by-call aspects of the service options is unlikely to have a great deal of effect on costs.

The costs stated here do not include any provision for upgrading the information systems themselves. Although the actual IS impact of equal access may be relatively small, it will necessarily hasten the decision to upgrade processor hardware and software. However this impact is very difficult to assess, and it is assumed that this situation does not cause serious impact in the time horizons of this study.

Staffing cost changes as a result of the operating system's increased complexity are shown below.

Other changes that might be made (eg to fraud detection systems, inter-network call accounting, etc) are not specifically associated with equal access, although it is just possible that the likelihood or economics of their implementation will vary between an equal access and a non-equal access situation. It is not believed that any significant changes to inter network call accounting will be required. The effective costs attributable to equal access introduction are likely to be relatively minor (probably a small fraction of £1M).

4.4.4. Data build

The most time consuming part of the installation of equal access in BT's network is the gathering, recording, checking, downloading, verifying, maintaining and modifying of customer preferences. It is estimated that each customer preference will take:

- £1 to gather (assumed to be by filed paper form);
- a minute to record or modify;
- two minutes to install and verify on the DLE.

Further it is assumed that each customer's preference status, whether a preselected operator is chosen or not, will take 10 seconds per year to check on CSS and a similar amount of time on his host DLE.

At £30k per man year this is equivalent to £2 per new pre-selection[33] and £0.15 per customer.

[33] We understand that in the US there is often a charge of around $5 for a pre-selection (borne either by the customer or the long distance operator).

The total costs for data build maintenance are estimated in Table 4.5. A total of 30 million lines is taken, and three alternative possibilities for rate of pre-selection choice by consumers.

Changes to the routing table databuilds are included in the switch reconfiguration capital and maintenance costs identified in Section 4.4.2.

Table 4.5
Data Build Maintenance Costs to BT (£ million)

Calendar year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
All line checks			4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	36.0
New pre-selections											
0.1m per year			0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.6
0.5m per year			1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	8.0
2m per year			4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	32.0

Source: Smith analysis

4.4.5. Staff, training and organisation

Additional changes as a result of equal access would involve staff training (for engineering staff, operators and back office staff) and possibly also manning levels for service support centres, at least temporarily.

BT estimates that additional costs of approximately £0.25M would be incurred for training. Assuming trainer fees of £30 per hour this amounts to four minutes of training time per member of BT staff, which seems light (even allowing for reasonably large class sizes and the fact that not all BT staff need be trained). The actual costs might be closer to £1M *per year*.

Manning across all disciplines may need to be extended to cover the surge in business activities from customer enquiries, through network configuration, information systems support and engineering, to system maintenance. Equilibrium configuration and maintenance costs are included in the network and IS development costs above. However additional costs would arise from:

- a permanent increase in customer service staff (taken to be 0.5% on an employee base of 30000);
- a temporary increase in all staff while the new system is bedding in (taken to be a 2% staff increase for one year on an employee base of 130000).

There is substantial uncertainty attached to both these assessments.

Salaries, other employee costs, accommodation and equipment support are taken at £20k per man year. The temporary increase would be spread over the years from 1997 on; although it might depend slightly on the implementation scenario this aspect is not believed to be significant and is not taken into consideration. Table 4.6 summarises these costs.

Table 4.6
Staffing and Training Costs to BT (£ million)

Calendar year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
Permanent staff			3	3	3	3	3	3	3	3	24
Temporary staff			52								52
Staff training			1	1	1	1	1	1	1		8
Total cost			56	4	4	4	4	4	4	4	84

Source: Smith analysis

Changes to BT organisation could also involve significant costs. However since these are likely to happen anyway it is believed that few costs accrue directly from equal access. (Consequent costs are identified in Section 4.6.)

These numbers are substantial. However, it is general experience that network changes have large knock-on effects; it is not unusual to find that in the case of introduction of complex new services only 10% of the costs are attributable to the network.

4.4.6. Alternative implementations

Intelligent Networking Solution

Moving towards an intelligent network would potentially involve the wholesale redesign of BT's network architecture. Clearly equal access could not be seen as the only or even the main driver for this, and the allocation of costs would be very difficult to assess.

A limited introduction of IN solutions for equal access only would be possible by routing all calls with initial 1 to a switching control centre for analysis. BT do not have real practical experience of "grafting" IN functions onto their network, but believe that US experiments with 800 numbers indicate that the costs are "expensive on a per call basis", at around US0.5¢ per call passed to the SCP.

Overall it does not seem realistic to assess the costs of an IN solution at present, although it is anticipated that equal access products could be installed relatively straightforwardly as part of a wider move towards IN service provision.

4.4.7. Summary

Table 4.7 summarises the undiscounted direct costs to BT, detailed in this section.

Table 4.7
Direct Costs to BT of Equal Access

Cost item	Total cost, £M (1995 - 2004)
Network (Scenario 1)	7.8
Network (Scenario 2)	13.9
Network (Scenario 3)	45.7
Network (Scenario 4)	102.0
Information systems	7.2
Data build maintenance	37.6 - 68.0
Staff, training and organisation	84.0
Total	**136.6 - 261.2**

Source: Smith analysis

4.5. Cost Analysis: Non-BT Systems

4.5.1. Introduction

In an equal access scenario, suppliers and customers of telecommunications services would need to change their own systems to exploit the benefits. These can be categorised as:

- changes to user systems (Section 4.5.2);
- changes to other long distance operators' systems (Section 4.5.3);
- changes to other local access operators' systems (Section 4.5.4).

4.5.2. User systems

Users might need new or reprogrammed end equipment. Smart box codes might need to change, and PABXs operating complex routing algorithms (eg least-cost routing, customer-configured private numbering schemes etc) would need to be reprogrammed. There is no

technical reason why end systems capable of handling easy access could not handle equal access, so this reprogramming should consist of:

- changing the data build;
- removing functions which are no longer necessary (although most users would presumably retain the functions in case they wished for more flexibility than the equal access service could offer).

There are unlikely to be significant knock-on effects on the market for end systems. Today's PABXs are capable of being programmed to exploit equal access services, and even domestic telephones often have memory buttons which can be programmed to dial access codes.

PABXs

It is estimated that there are some 100000 PABXs in the UK which have the capability to offer some kind of least cost routing (lcr) service. The impact of equal access on these may take the following forms:

- changing the configuration to exploit the equal access service;
- reconfiguration to maintain least cost routing as the market prices of different operators change;
- reductions in the requirement for reconfiguration owing to the equal access service.

Initial costs of changes to the PABX, required when the customer changes its pre-selection(s) should be small - say a morning's work (3 hours at £30k per man year = £50). Thus even universal adoption of equal access would only cost £5M. A figure of £1M is taken for the purposes of this study.

Reconfiguration costs are difficult to assess since they depend on local practice. However, it can be said that PABX owners, that manage their PABX configurations closely probably have close to optimal least cost routing (relative to the current market prices). So although their reconfiguration costs will be reduced by equal access (e.g. because pre-selection is done by the network), they will see less benefit from equal access. Conversely, PABX owners with a relaxed approach to least cost routing will not save on reconfiguration, but may gain more from the benefits of equal access.

Our assessment is that equal access services will not change reconfiguration costs substantially relative to the current position.

The same conclusion also applies to privately managed networks, ie. there will be little change in management cost owing to the availability of equal access services.

Changes associated with Centrex services would probably be similarly straightforward to implement. However, if they were not, there would be no obligation for Centrex subscribers to take equal access.

Single user equipment

Smart boxes and blue button phones etc. provide domestic and small business subscribers with a function similar to the lcr functions available on a PABX. Mercury has a substantial installed base of blue button phones; Energis is the only major near term user of smart boxes in the UK, although other PTOs (e.g. Sprint) are also intending to use them.

Updating user equipment with new software and data to exploit equal access services may be done in one of four ways:

- user reprogramming;
- downloading over the network;
- box replacement/reprogramming on the customer's site;
- box replacement/reprogramming on the supplier's site (eg by post).

Blue button phones are reprogrammable by the user. This is essentially a cost-free item, although it might generate a need for customer service contact.

Smart boxes would normally be remotely reprogrammable via the network management system, at a cost of not more than £1 - £5 per box plus the development cost of the download software (say £100k). However, Energis believe that the availability of equal access services may enable the smart boxes to be removed altogether, so that this cost would be avoided. The cost of changing user equipment is therefore likely to be small.

Information systems

There should be little impact on users' information systems, although there will be an administrative requirement to maintain a slightly more complex database of telecommunications service usage. The cost is assumed to be negligible.

Staff etc

Users should not incur significant staff costs. It is possible that they will need to expend a small amount of additional effort to analyse equal access service offerings but this is taken to be part of the normal business planning function. The cost is assumed to be negligible.

4.5.3. Other long distance operators

Network and central IS

There would be little direct cost or saving to central aspects of other operators' networks and operational information systems which can be attributed to equal access. Handover between carriers would not change significantly. The main perceived benefit is the impact in opening up the market[34], which is discussed in Chapter 3.

However there would be a significant overhead involved in administering the preferences of existing, past, and potential customers. The second and third are considered a marketing issue and not costed. It is assumed that there is no specific requirement for OLOs to reconcile preferences with BT except where a change in preference has been indicated to one party or the other.

It is estimated that each customer preference will involve a similar administrative expense to that incurred by BT (Section 4.4.4), except that there is no DLE configuration step:

- £1 to gather (assumed to be by filed paper form);
- minute to record or modify.

At £30k per man year this is equivalent to £1.30 per new pre-selection.

Further it is estimated that the capital cost of developing customer database tools will be £1M (less than for BT because there is no need to manage all lines or to provide the DLE configuration management functions). Annual maintenance is taken to be 10% of capital expenditure.

[34] International operators which are not also national long distance operators are excluded from this analysis. In general the network and administrative costs would be even smaller than for national long distance operators, reflecting the smaller market.

Table 4.8 indicates the cost profile in this area (in £M).

Table 4.8
Information Systems Costs for Other Long Distance Operators (£ million)

Calendar year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
System development			1.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.0
New pre-selections											
0.1m per year			0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	1.04
0.5m per year			0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	5.2
2m per year			2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	20.8

Source: Smith analysis

Subscriber premises equipment

A number of operators provide, or will provide, smart boxes at prices below production costs (in some cases free). Although the functions of these smart boxes vary, all will enable customers to perform 'do it yourself' pre-selection. In some instances, changes in smart box functions as a result of the introduction of equal access could have a knock on impact on central systems. At present, Energis' boxes will provide both digit adding and subscriber line management functions. Equal access would make the digit adding element of the smart box redundant, and could thus alter the economics of providing the smart box. In particular, Energis might centralise its network management and dispense with the smart box altogether. This would produce savings for Energis, but we estimate that the savings would not exceed £10M.

Staffing, training and organisation

As the network and central IS changes for other long distance operators are likely to be small, most of the impact on their staff will fall on the customer service function.

Of the ~10000 staff employed by the non-BT long distance operators, it is estimated that 3000 are customer service staff (a slightly higher proportion than for BT, because of the differences in architecture). Costs are taken *pro rata* to BT (Section 4.4.5); this may be a conservative estimate, depending on how publicity/administration is arranged.

Costs therefore arise from:

- training (estimated at £0.03M per year, over all OLOs);
- permanent staff increase (0.5% on an employee base of 3000);
- temporary staff increase (2% for one year, also on an employee base of 3000).

Salaries, other employee costs, accommodation and equipment support are taken at £20k per man year. The totals are shown in Table 4.9 (in £M).

Table 4.9
Staffing and Training Costs for Other Long Distance Operators (£ million)

Calendar year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
Permanent staff			0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	2.4
Temporary staff			1.2								1.2
Staff training			0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.24
Total cost			1.53	0.33	0.33	0.33	0.33	0.33	0.33	0.33	3.84

Source: Smith analysis

4.5.4. Other Local Operators

Other local carriers would only be affected if the requirement to implement equal access services became mandatory for them as well as for BT (ie if they reach a 25% market share). This is most likely to be the case for cable TV operators who will achieve relatively high take-up of telephony within their franchise areas. We estimate that over half will breach the 25% market share level by around the year 2000. Ionica and other local operators will have lower market shares on a wider customer base.

A typical cable operator might have a single System X or AXE10 switch to cover its franchise area (for the medium term). Other local/regional operators (e.g. Kingston, COLT) might have a small number of such switches. National local loop operators (eg Ionica) would roll out a number of switches across the country, sufficient to provide the line capacity.

Cable operators would need to procure a switch before launching telephony services. Other local access providers would be expected to procure switches broadly as needed.

We have assumed that other operators would be supporting some 400 large switches by the beginning in 2000. Not all of these will be required to support equal access (since the operators will not have sufficient market share). If 200 of these switches were required to implement equal access the costs would be:

- software upgrade/switch configuration: £100k per switch;
- information systems upgrade: £100k per switch;
- data build: similar to BT, except all subscribers will have preferences to log initially; it is assumed that 10% of them change each year;
- staffing: permanent staff and training *pro rata* to BT, no temporary staff.

The overall costs are shown in Table 4.10 (in £M).

Table 4.10

Cost of Equal Access Provision by Other Local Access Operators (if marketed)

Calendar year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
Network costs						20.0	2.0	2.0	2.0	2.0	28.0
Information systems						20.0	2.0	2.0	2.0	2.0	28.0
Data build						6.45	1.05	1.05	1.05	1.05	10.65
Staff, training and organisation						0.4	0.4	0.4	0.4	0.4	2.0
Total						46.85	5.45	5.45	5.45	5.45	68.65

Source: Smith analysis

4.5.5. Summary

If other local access operators are required to offer equal access the costs could be large.

If not, then the impact on non-BT systems is relatively small. Users might need to bear a cost of a few £M to update their systems, and other operators might see a saving of a few £M (on a rationalised system architecture) and costs of a few £M (on administration and training).

4.6. Consequent Costs

4.6.1. Publicity

In the event of a move to equal access, publicity costs would be significant. The cost of this which is directly attributable to equal access is difficult to assess: clearly there is some pure "information dissemination", but this will shade into marketing activities with no clear dividing line. If a subscriber ballot were to be undertaken, it might be reasonable to treat the full ballot costs - and no others - as being related to the introduction of equal access.

4.6.2. Traffic Volatility

If equal access is to be effective it will result in migration. In the case of pre-selection, this will be a migration of customers and their calls (although we understand that US experience suggests this may be low), whilst in the case of call-by-call selection it will be a migration of just calls.

The outcome of a pre-selection ballot in any area will inevitably be uncertain. Given this uncertainty, all operators will need to carry additional capacity to make available an acceptable grade of service under all likely ballot outcomes. Under call-by-call selection, or over-rides under pre-selection, traffic may migrate between networks on a day-by-day (or hour-by-hour) basis, in response to marketing and advertising efforts by different operators. Examples of this would be BT's Sunday special campaigns, or One-2-one's free

Christmas calls. Again there will be considerable uncertainty over the impact of these campaigns (especially when they depend on the activities of competitors) and so operators will need to carry additional network capacity to meet grade of service requirements. This additional capacity requirement (much of which will stand idle until traffic surge) imposes additional investment costs on all operators with no pay-back in terms of overall traffic growth.

The use of optical fibre technology in long distance networks means that the additional investment in transmission equipment in order to provide this extra capacity may be small (especially for new operators), the impact of investment in switching equipment is likely to be much more marked.

4.6.3. Potential interactions of equal access

Mechanisms would need to be in place to ensure that the incidence of adverse interactions between equal access and other services are minimised. It is difficult to assess the cost of this, because it is not clear what the interactions would be or how acceptable they are. Possible services affected are:

- network services such as CLIR;
- call barring services.

It is believed that the impact is not likely to be much greater than for easy access, as indicated by the impact of 141 on PABX users and MCL services. (It could be argued that moving routing selection to BT's network from PABXs will enable a more coherent integration with other routing products. However customers are likely to want to retain control over many aspects, including call barring.)

A decision would need to be made on how to handle special calls, eg MCL's Freefone numbers (0500). However this is not expected to cause technical problems, beyond the complexity of designing the decode tree.

4.7. Total Costs

4.7.1. Equal Access with Pre-selection

On the basis of the analysis in Sections 4.4 to 4.6, the undiscounted costs of implementing equal access (in £M, summed over the period 1995 - 2004 inclusive) with pre-selection are shown in Table 4.11.

Table 4.11
Overall Costs (1995-2004) (£ million)

Whose system bears the cost	BT	Other long distance	Other local operators[35]	Users	Total
Network costs	7.8[36]	negligible	28.0	N/A	35.8
Information systems	7.2	1.8	28.0	negligible	37.0
Data build	44.0[37]	5.2[7]	10.65	N/A	59.85
Staff, training and organisation	84.0	3.84	2.0	negligible	89.84
End systems	negligible	-10.0[38]	negligible	1.0[39]	-9.0
Publicity etc	-	-	-	-	excluded
Total	143.0	0.84	68.65	1.0	213.49

Source: Smith analysis

4.7.2. Call by Call Equal Access

The costs of implementing call by call equal access only are estimated to be as shown in Table 4.12 (in undiscounted £M, summed over the period 1995 - 2004 inclusive).

[35] If required to implement equal access (scenario described in Section 4.5.4).

[36] Assumes Scenario 1 (described in Section 4.4.2).

[37] Assumes 0.5m BT customers per year change their preference status.

[38] Savings attributable to Energis' ability to centralise line management.

[39] Assumes a total of 20% of reprogrammable PABXs are reconfigured over the course of the time period.

Table 4.12
Overall Costs for Call-by-call equal access (1995-2004) (£ million)

Whose system bears the cost	BT	Other long distance operators	Other local operators[40]	Users	Total
Network costs	3.6	negligible	7.0	n/a	10.6
Information systems	1.6	0.2	7.0	negligible	8.8
Data build	negligible	negligible	negligible	n/a	0.0
Staff, training and organisation	27.2	1.1	0.4	negligible	28.7
End systems	negligible	negligible	negligible	1.0	1.0
Publicity etc	-	-	-	-	excluded
Total	**32.4**	**1.3**	**14.4**	**1.0**	**49.1**

Source: Smith analysis

[40] If required to implement equal access (scenario described in section 4.5.4).

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5. RESULTS AND SENSITIVITY ANALYSIS

5.1. Outcome of the Cost-Benefit Analysis

Table 5.1 combines the results of the benefits and costs estimated in the last two chapters into a net present value (NPV), using a discount rate of 6% (for reasons discussed in Section 1.2.4). In doing this we have taken an extended period from 1995 to 2010 to allow sufficient time for the full benefits of equal access to become apparent. The costs for the period 2005 to 2010 are simply a continuation of the on-going hardware, software and support system maintenance costs, and variable costs per pre-selected subscriber. Clearly this assumes that current network technology and information system technologies stay constant. We have assumed that BT will implement equal access in the cheapest way - ie. in line with a rolling programme of switch modernisation (Scenarios 1 and 3 of Chapter 4). In addition to the costs identified in the last chapter, balloting costs (excluding databuild) have been added, at 25p per pre-selecting subscriber. It is assumed that ballot papers can be sent out with existing telephone bills, thus saving costs.

For the base runs, costs exceed benefits and all options have negative NPVs. Options 1 and 2 have the lowest negative NPVs reflecting the fact that these options generate the largest benefits.

Table 5.1
Summary of Results of Cost-Benefit Analysis: Base Run

	Option 1	Option 2	Option 3	Option 4
Discounted sums (1995 to 2005) (£millions)				
Type I benefits	£20	£20	£7	zero
Type II benefits	£59	£59	£36	zero
Total benefits	£79	£79	£43	zero
Costs for one pre-selection	£162	£162	£160	£47
Benefits less costs (1 select.)	-£83	-£83	-£118	-£47
Costs for two pre-selections	£187	£187	£186	n/a
Benefits less costs (2 select.)	-£108	-£108	-£143	n/a
Discounted sums (1995 to 2010) (£millions)				
Type I benefits	£35	£35	£12	zero
Type II benefits	£164	£164	£89	zero
Total benefits	£199	£199	£100	zero
Costs for one pre-selection	£208	£208	£204	£47
Benefits less costs (1 select.)	-£9	-£9	-£103	-£47
Costs for two pre-selections	£239	£239	£235	n/a
Benefits less costs (2 select.)	-£41	-£41	-£135	n/a

n/a is not applicable

Source: NERA analysis